

Linear Industries, Inc.

# AT71K0-1 Owner's Manual



July 2009

# User Notices and WARNINGS

## USER NOTICES

IT IS VERY IMPORTANT TO READ THIS MANUAL PRIOR TO OPERATION OF THIS TRANSMITTER!

### Notice 1

The transmitter main operating voltage setting is marked on the rear of the AT71K0-1 chassis.

### Notice 2

The transmitter operating frequency is set from the factory.

### Notice 3

For adjusting the RF output power setting a qualified technician should always employ the use of an RF Wattmeter and a calibrated dummy load.

### Notice 4

Should accident or injury occur to the personnel engaged in the installation, operation, or service of the equipment, they should seek proper medical attention. It is advisable that such personnel have familiarity with first-aid practices.

### Notice 5

For technical support please call the Linear technical support customer service line at 847/428-5793 ext. 105.

### Notice 6

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**WARNING!**

THE VOLTAGES AND CURRENTS IN THIS EQUIPMENT ARE DANGEROUS. PERSONNEL MUST, AT ALL TIMES, OBSERVE SAFETY WARNINGS, INSTRUCTIONS, AND ANY LOCAL REGULATIONS.

THIS OWNER'S MANUAL IS INTENDED AS A GENERAL GUIDE FOR TRAINED AND QUALIFIED PERSONNEL WHO ARE AWARE OF THE DANGERS THAT ARE INHERENT IN THE HANDLING AND OPERATION OF POTENTIALLY HAZARDOUS ELECTRICAL AND ELECTRONIC CIRCUITS. IT IS NOT THE INTENT OF THIS MANUAL TO PROVIDE A COMPLETE SET OF SAFETY INSTRUCTIONS OR PRECAUTIONS THAT SHOULD ALREADY BE UNDERSTOOD BY TRAINED OR EXPERIENCED PERSONNEL IN USING THIS OR OTHER TYPES AND FORMS OF ELECTRONIC EQUIPMENT.

THE INSTALLATION, OPERATION, AND MAINTENANCE OF THIS EQUIPMENT INVOLVE RISKS TO PERSONNEL AND ALSO TO THE EQUIPMENT. LINEAR, INC. SHALL NOT BE RESPONSIBLE FOR INJURY OR DAMAGE THAT IS THE RESULT OF IMPROPER PROCEDURES OR USE BY INDIVIDUALS IMPROPERLY TRAINED OR LACKING THE KNOWLEDGE TO PERFORM ASSOCIATED TASKS.

ALL LOCAL CODES FOR BUILDING, SAFETY, FIRE, OR RELATED STANDARDS MUST BE OBSERVED. CONSULT LOCAL AUTHORITIES FOR THE STANDARDS FOR THE AREA OR REGION WHERE THE EQUIPMENT WILL BE INSTALLED AND PUT IN USE.

**WARNING!**

AT ALL TIMES DISCONNECT AC/MAIN POWER BEFORE OPENING COVERS, DOORS, ENCLOSURES, PANELS, OR PROTECTIVE SHIELDS THAT EXPOSE LIVE CIRCUITS. NEVER PERFORM MAINTENANCE, MAKE ADJUSTMENTS, OR SERVICE THE EQUIPMENT WHEN ALONE OR FATIGUED.

**WARNING!**

IF ELECTROLYTIC OR OIL FILLED CAPACITORS ARE UTILIZED IN THE EQUIPMENT AND THE COMPONENT APPEARS LEAKY, OR IS BULGING, OR IF THE CASE OR COVERING OF THE COMPONENT APPEARS DAMAGED OR DISTRESSED, ALLOW SUFFICIENT TIME FOR THE UNIT TO COOL OR FULLY DISCHARGE BEFORE SERVICING. SERVICING HOT OR LEAKY CAPACITORS CAN CAUSE A RUPTURE OF THE CASE AND POSSIBLE INJURY.

## Returns and Exchanges

Equipment (Damaged or undamaged) should not be returned unless written approval and a Merchandise Return Authorization (MRA Number) is received from your Linear Sales representative or Linear Customer Service. Special shipping instruction will be provided which will assure proper handling. The circumstances and reasons for the return must be included in the request for return. Equipment that is special or "custom" ordered may be not returnable. In situations where return or exchange is at the request of the customer a restocking fee may be charged. All returns must be sent freight prepaid and properly insured by customer. When communicating with Linear please refer to your Order or Invoice Number.

## Unpacking

Use care when unpacking the equipment. First perform a visual inspection of the item(s) to determine if any damage occurred during shipment. Be sure to retain all the shipping materials (crates and boxes or cartons) until such time that it has been determined that the received equipment arrived undamaged. Find all PACKING LISTS and keep them to assist in locating and identifying any components or assemblies that may have been removed for shipping and might need to be reinstalled in the equipment. Make sure that all shipping straps, supports and packing materials are completely removed from the equipment prior to initialization and use.

# AT71K0-1 General Description

## 1. INTRODUCTION

AT71K0-1 is a 1000W UHF ATSC Digital Broadcast Transmitter. It uses state-of-the-art technology of transmission of the digital signal for TV broadcast. It carries an intelligent digital control using microcontrollers, which allows for remote supervision in real time of all transmitter functionality. The 4 built-in wheels provide mobility of the cabinet; the wheels can be mechanically locked when the transmitter is set in a desired position.

All operations of the AT71K0-1 is carried-out through a keypad and digital display, located on the front panel, including access to all the readings, alarms and configurations.

The RF amplification system constitutes three drawers of up to 400W rms each connected in parallel, each one comes with an independent power supply and supervision function. The FCC Mask filter is installed on the top of the cabinet (not shown on the pictures below).

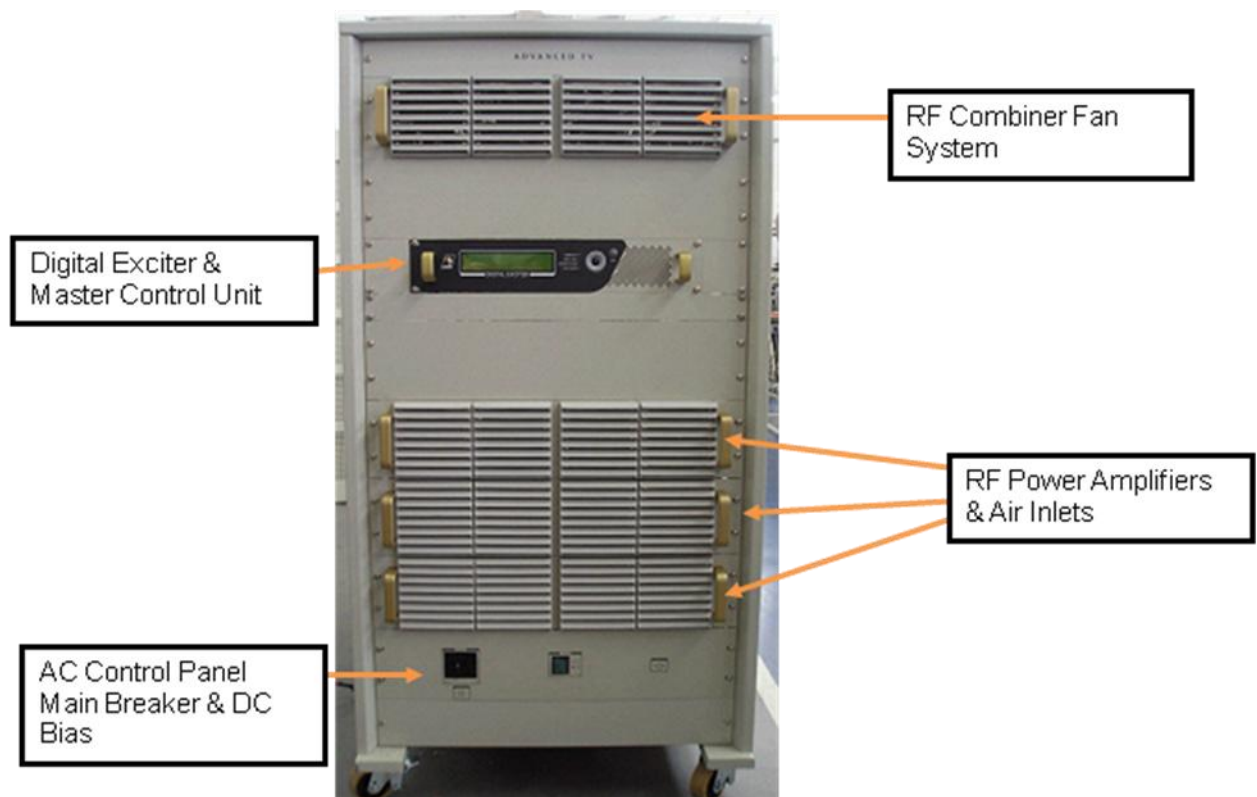


Figure 1: AT71K0-1 - Front View

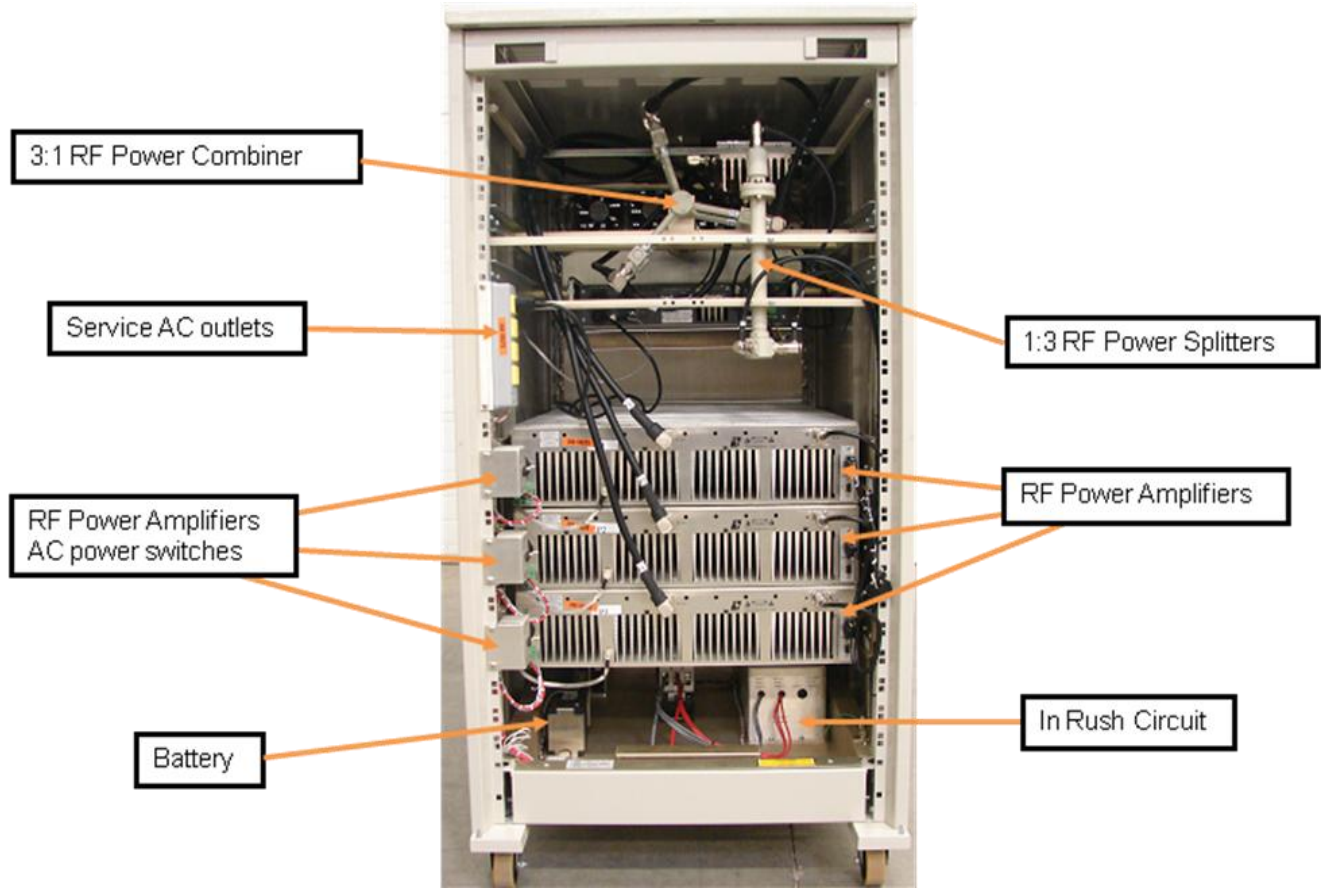


Figure 2: AT71K0-1 - Rear View, back cover panel removed

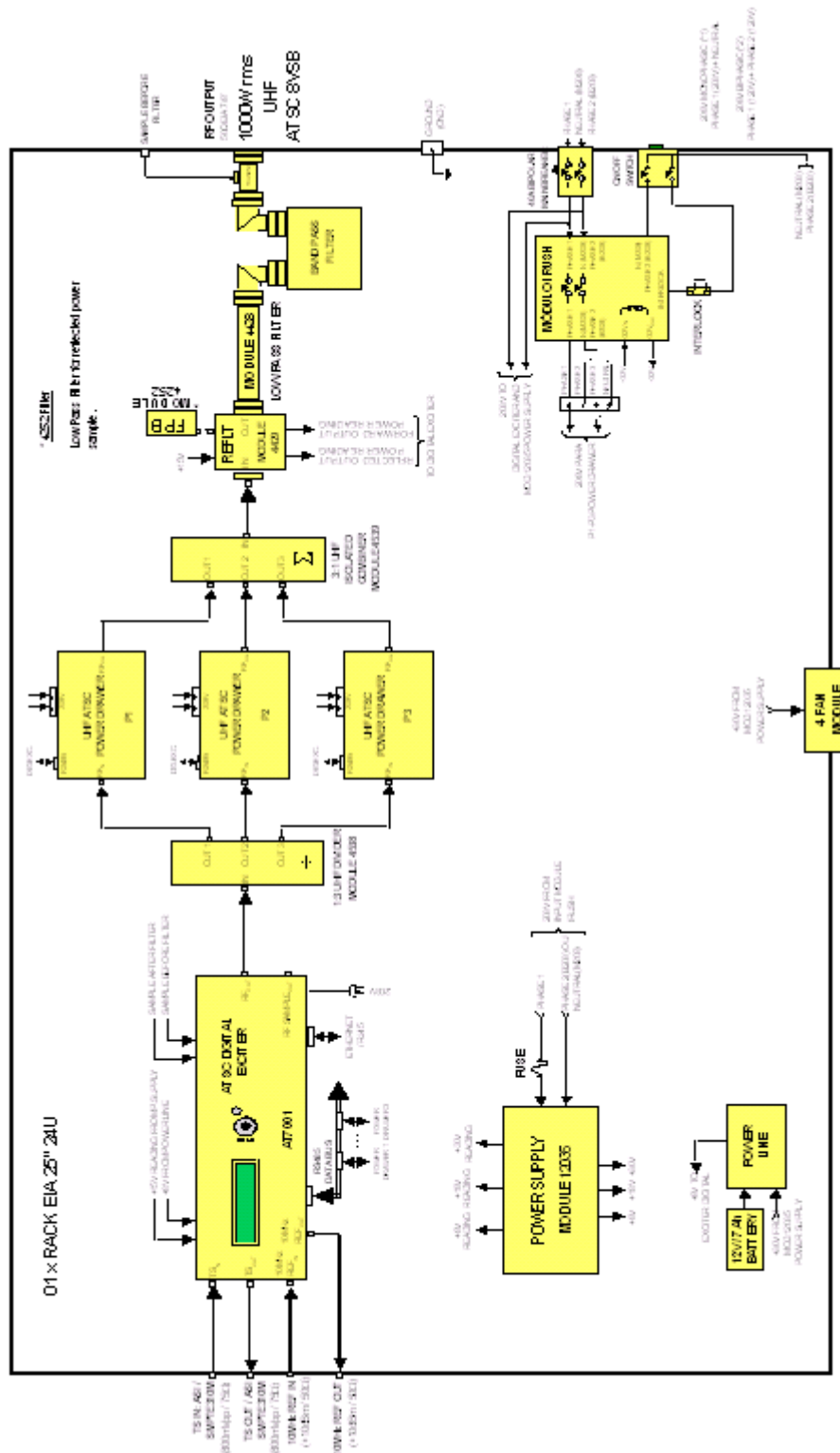


Figure 3 - AT71K0-1 - Block Diagram

## 2. Main Features

- Via the 4 lines x 40 columns display keypad located at the front panel it is possible to manage, configure all functions of the equipment and each one of the RF power drawers.
- Via the hyper-terminal it is also possible to manage, configure all of the functions of the transmitter and each one of the RF power drawers.
- Digital Filter, type Finite Impulse Power (FIR) built-in at the 8VSB Modulator.
- Automatic non linear pre-correction.
- Automatic linear equalization.
- Built in oscillators synthesized via serial-PLL, locked at a 10MHz OCXO reference or external equivalent reference, e.g. GPS signal.
- The UHF RF power amplifiers were implemented with LDMOS transistors, operating highly linearly at higher gain under high efficiency and absolute controlled thermal conditions.
- Automatic control over the quiescent operational electrical current value on the RF main power transistors, under temperature variations.
- Self-protection against over-current on the RF main power amplifiers.
- Each RF power module carries its own +32volts full bridge type switching power supply.
- Automatic Level Control (ALC) control, which keeps the RF on-channel output level constant, even with a +3 dB overall system gain variation.
- System fault indication shown on the front panel, including current and past alarms log.
- Low noise fans for the air cooling system.
- Modular design, built with SMD (Surface Mounted Devices), easing the maintenance and service.
- Outstanding overall field system performance.
- 25" rack cabinet.



### 3. AT71K0-1 stage-by-stage

1. Digital Exciter
2. RF Power Splitter, 1:3
3. 3 RF power drawers
4. RF Power combiner, 3:1
5. RF Sampler
6. Output FCC mask filter.
7. Energy system
8. Cooling system

### 4 General Description by stage

#### 4.1 Digital Exciter, model AT7001.

The digital exciter unit is also the control and monitoring system for the entire transmitter.

- 8VSB Modulator
- IF/UHF Up Converter
- Power Supply
- RF Amplifier
- Master Control Unit

The AT7001 input is a single BNC connector that may receive either an ASI or SMPTE310M transport stream. The modulation process follows ATSC A/53E recommendation, and is a complex modulation process generating identical phase-modulated orthogonal IF carriers, (I) and (Q) at frequency of 18.833916 MHz.

Both (I) and (Q) modulated carriers are routed into the IF/UHF up-converter. The local oscillator is a synthesized time-based PLL via an internal OCXO (Oven Controlled Crystal Oscillator) at 10MHz reference, or an equivalent one external reference, e.g. a GPS signal. The on-channel modulated signal is routed to the RF amplifier, a class A highly linear amplifier with enough head room to accommodate future signal amplitude expansion during the non-linear pre-correction process.

The AT7001 output delivers a variable 100mW max RF output level, (+20dBm) at the desired UHF channel, driving the RF power amplifiers line-up.

The Master Control Unit (MCU) of the unit is embedded in the AT7001. The MCU interacts with all functionality present within the equipment. It further interfaces externally via a keypad and an LCD display.

The MCU receives information proceeding from several modules, as the DTV modulator, Up-Converter, RF amplifiers, RF samples and the administration of passwords. Via keypad it is possible to read and program the power level delivered by the transmitter. Major changes on the transmitter configuration are possible with factory assistance.

The AT7001 is factory-set in one of four (4) optional versions. Depending upon the version it is possible set the operation with 2 types of non-linear pre-correction, mask filter equalization and/or ATSC set of 13 measurements on the RF signal demodulated.

#### **4.2 RF Power Splitter**

The power splitter is a passive non-isolated component. It equally splits the exciter's on-channel RF signal to the ratio of 1:3. The resultant split signal is then routed to the 3 RF power amplifier drawers.

#### **4.3 1,000+ watts RF power structure**

The main power amplification system is built with 3 RF power drawers in parallel. Each drawer carries a set of 12 fans, switching power supply, 3 RF pallets, an intermediate power amplifier, a removable (plug-in) control system based on microcontrollers and includes a hyper-terminal interface.

The use of the hyper-terminal interface allows the operator to adjust the quiescent RF transistor's current via software. It is also possible to retrieve data information regarding RF transistor current variations as a function of the temperature variation. Further, it is possible to collect valuable system information related with the RF drawer serial number, embedded software name and version, direct and reverse RF power readings, one-by-one RF transistor current readings, and detailed descriptions about current and past alarms.

#### **4.4 RF Power Combiner**

The RF power combiner is a 3:1 isolated passive component. Being isolated, it includes associated unbalanced loads attached to a fin heat sink. The 3 inputs of this combiner are the output of each RF power drawer.

#### **4.5 RF Power Sensor. RF sample.**

RF samples associated with the direct and reverse RF power are detected with this unit, and converted to proportional DC readings. These 2 DC levels are routed to the MCU located in the exciter where they are processed and displayed on the LCD screen. The processing of this analog information manages the RF power delivered by the transmitter, increasing or reducing it as part of the automatic level control (ALC) and is a part of the automatic linearization/equalization of the transmitter. The RF samples are available in two points in the

RF path (line-up), BEFORE and AFTER the RF output filter. The second set of RF samples is the last element on the transmitter line-up, directly connected to the output transmission and antenna system.

#### 4.5 Output Mask Filter

The UHF RF channel output filter is a tunable band-pass six pole elliptical synthesis type filter. This filter reduces the unwanted spurious and harmonics signals inherent in the RF amplification process. The filter bandwidth and attenuation specifications are two important components that help the transmitter to meet the FCC and ATSC A/53E specification recommendation.

#### 4.7 Power Supplies

All power transmitter supplies are full bridge switching power supplies. Each amplifier drawer, total of 3, carries its own power supply, with individual shut-down commands. These power supplies are in constant communication with its respective drawer control unit. The communication collects and distributes the voltage value (+32V nominal) and the electrical instantaneous current values in Ampere. The normal main value for all power supplies is 208Vac. The three different models present on this transmitter are:

- Module 4571 – At the digital exciter, AT7001
- Module 4568 – RF Power amplifiers drawers
- Module 12035 – General Power Supply

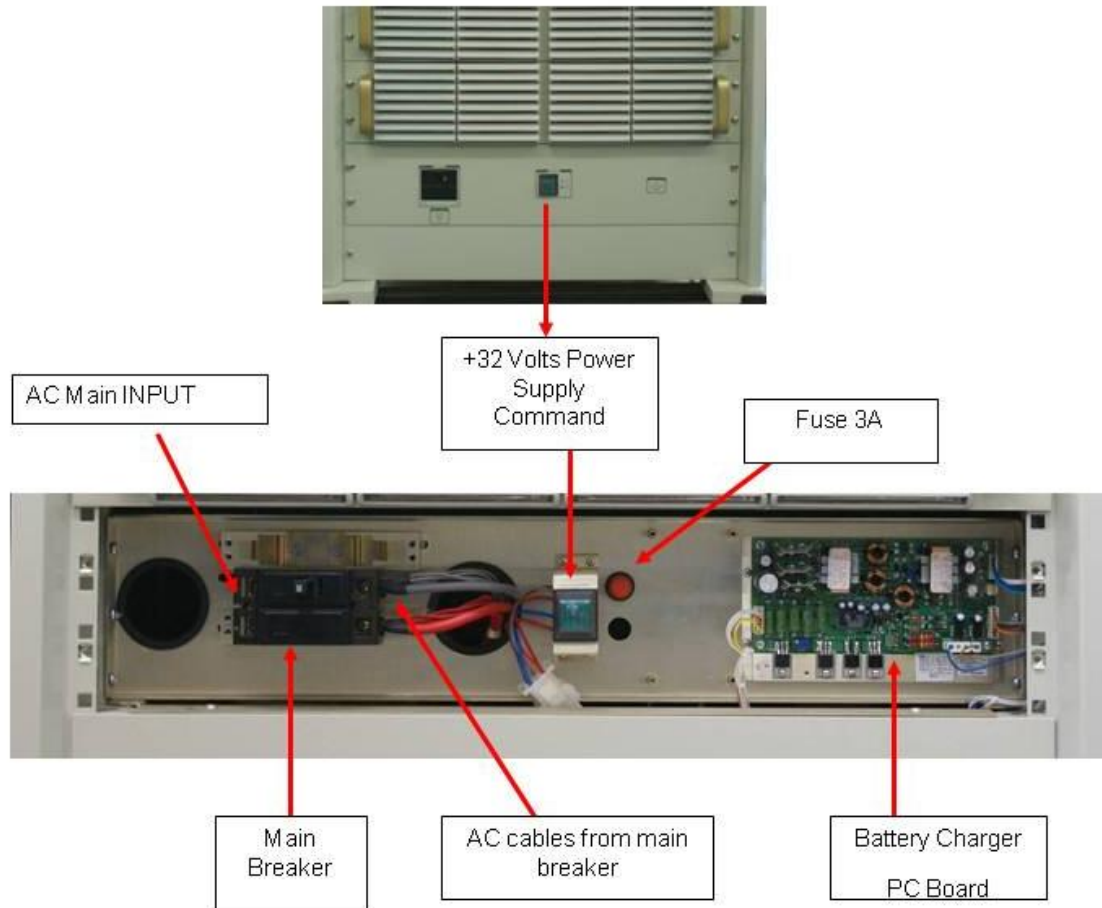
#### 4.8 Energy Distribution

The transmitter configuration is either:

- 208V<sub>AC</sub> Mono-phase.
- 208V<sub>AC</sub> Bi-phase.

The In-Rush circuit is part of the electrical distribution system. This circuit drastically reduces any spikes of current generated by the switching power supplies at the moment the transmitter is turned ON. There is also a DC/DC converter circuit. This circuitry recharges the 12V@7Ah battery. In an event of lack of AC input power, the battery feeds the MCU circuit keeping for a prolonged period of time the set of parameters previously programmed.

#### 4.5.1 AC control panel & battery charger



**Figure 4 – AT71K0-1 AC Front Panel (panel cover removed)**

#### 4.6 Cooling System

The cooling system is based on a set of fans that force air into the transmitter drawer's heat sinks. The fans are mixed, located on the front panel and internally within the units. The air outlet holes on the top cover and the rear panel of the transmitter facilitate the air flow.

## 5. AT71K0-1 - 1000W UHF ATSC/8VSB Transmitter - Technical Specifications

<b>Electrical</b>	
Main	180 ~ 240 VAC, bi phase, 50-60 Hz.
Consumption	11,500 W
Power Factor Correction, FPC.	Included
<b>Signal Input</b>	
Transport Stream Input	ATSC/MPEG2, compliant to SMPTE310M or ASI
Input Data Rate	19.39 Mbps (SMPTE / 310M) / 270Mbps (ASI)
External Reference Signal	10MHz. (0 to +10 dBm).
Input Connector	75Ω (BNC),
Reference Input Connector	50Ω (BNC),
<b>RF</b>	
Modulation Mode	8VSB.
IF	18.833916 MHz.
Channel Bandwidth	6MHz.
Test Signal	PRBS
Frequency Range	UHF. C14 to Ch59, (4 bands).
Frequency Step	1 Hz. ± 220kHz
Symbol Rate	10.76 MSymbol/sec.
Digital/Analog Converter	16 bit
Both Linear and Non-Linear Pre-Correction at factory	Included
Pilot frequency stability overall	±0.3 ppm
Peak to peak frequency response	≤ 0.2 dB
Peak to peak group delay response	≤ 20 ns.
Phase noise	≲ -104 dBc/Hz @ 20kHz offset.
Conducted spurious and harmonics	< -60 dBc, FCC 47 Part 74.
Radiated spurious and harmonics	< -80 dBc, FCC 47 Part 74.
MER (Modulation Error Rate)	≥ 33 dB (transmitter output) typical.
RF output connector	EIA 1 5/8" flanged
Output sample connector	N
<b>Communication</b>	
Hyper-terminal	RS232 (DB-9)
<b>Mechanical</b>	
Dimensions	49.7"(H), 27.7"(W), 45.67"(D)
Weight	NET: ≅ 340 Kg

## Annex A – AT71K0-1 Operational Software

### 1. Introduction

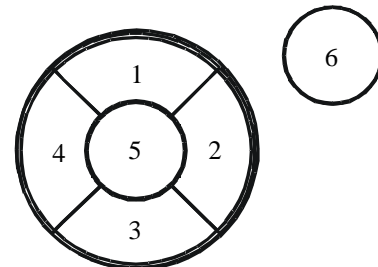
The DTV transmitter AT71K0-1 provisions: (a) measurements, (b) configurations, (c) alarms, and (d) remote control via microcontrollers.

Below is a detailed description about the operational software (configuration and operation) system installed in the AT71K0-1, located within the AT7001 exciter.



Figure 5 AT7001 – Front Panel

### 2. Digital Exciter – The Master Control Unit



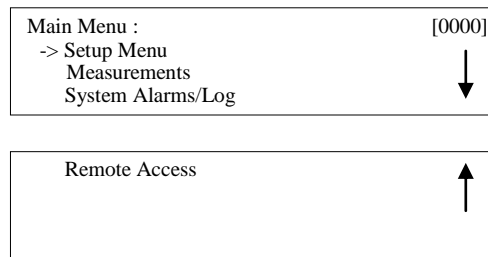
#### 2.1 Keypad

- (1)  Moves the arrow UP to the next function shown on LCD screen
- (2)  Moves the arrow to the next RIGHT position
- (3)  Moves the arrow DOWN to the next function shown on LCD screen
- (4)  Moves the arrow to the next LEFT position
- (5)  ENTER – Confirms the chosen selection
- (6)  ESC – Cancel the selection and return to the previous screen.

## 2.2. LCD Display

To browse over the LCD screen follow the instructions below:

- Move the arrow Up or Down to the item listed by pressing the (1) or (3) buttons.



- Hit ENTER.

### Remarks:

Please note that all screens are assigned a 4 digit number on the top-right of the LCD screen. These numbers, represents the screen position on the command menu.

## 2.3. Signaling

Besides the LCD screen and the command keypad, the front panel of AT7001 also shows a set of 4 LED's. These LED's when ON indicate:

POWER ON – Energy is present.

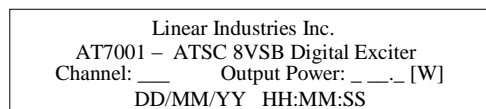
SYNC. LOSS – The INPUT transport stream is not present.

CURRENT ALARM – One or more alarm situations are occurring.

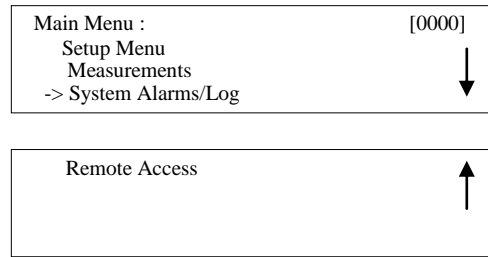
PAST ALARM – Alarm log screen.

## 3. Initialization:

The first screen that appears when powering ON the transmitter is:



After pressing any key on the keypad, the next screen that appears is:



(Note: It is always possible to return to the initial LCD screen by pressing the ESC key)

After 5 minutes the initial LCD screen menu is displayed.

#### 4. Measurement System Table

Measurements Menu Indications	Measurements Sub-Set Indications	Description	
POWER	Forward	Measure the Direct Power	
	Reflected	Measure the Reverse Power	
	Voltage ALC	Measure the ALC control voltage	
TRANSPORT STREAM	Transport Stream	Shows the INPUT transport stream protocol, or none.	
	Data Packets Rate	Measure the input Data Rate: 0 ~ 19,39Mbps	
	Null Packets Rate	Measure Nulls packages: 0 ~ 19,39Mbps	
	FIFO Occupation (%)	0 ~ 100%	
RF AMPLIFIER DRAWERS	POWER	+32V Power Supply for the RF power drawers.	
		RF Forward Power per each drawer.	
	CURRENT	Measure the electrical current at the drawers	
	TEMPERATURE	Temperature measurements	
EXCITER POWER SUPPLY	Voltage	+15V	+15V voltage power supply measurement
		+8V	+8V voltage power supply measurement
		+3V	+3V voltage power supply measurement
		+27V	+27V voltage power supply measurement
COMMUNICATION STATUS	COMMUNICATION	Indicate the communication status among the RF drawers and the MASTER Control Unit.	
POWER SUPPLY MEASUREMENTS	15V	+15V voltage power supply measurement	
	8V	+ 8V voltage power supply measurement	
	Battery	+15V voltage battery measurement	

To access the menu above, see item 4.1 below:



#### 4.1. Transmitter Power Measurements

Main Menu :	[0000]
Setup Menu	
-> Measurements	↓
System Alarms/Log	

Remote Access	↑
---------------	---

#### Access Measurements

Measurements :	[2000]
-> Power	
Transport Stream	↓
Drawers	

Exciter Power Supply	↑
Communication Status	
Power Supply	

#### Access **Power** and hit ENTER

- Hit key "3" to view the other screens that are part of this menu.

Transmitter Power Measurements :	[2100]
Programmed:	
Forward: ____ [W]	Reflected: ____ [W]
ALC Reference Voltage : ____ [V]	

Hit ESC key to return to the prior screen.

## 4.2. Transport Stream related measurements

To gather information about the status of the incoming transport stream, follow the instructions below, starting on the main menu screen:

Main Menu :	[0000]
Setup Menu	
-> Measurements	↓
System Alarms/Log	

Remote Access	↑
---------------	---

### Access Measurements

Measurements :	[2000]
Power	
-> Transport Stream	↓
Drawers	

Exciter Power Supply	↑
Communication Status	
Power Supply	

Select **Transport Stream** and hit ENTER

Transport Stream Measurements:	[2200]
Transport Stream :	
Data Packets Rate :	↓
Null Packets Rate :	

FIFO Occupation (%):	↑
----------------------	---

Hit ESC key to return to the prior screen.

### 4.3. RF Power Drawers Measurements

For each RF Power Module it is possible to measure: (a) electrical current, (b) RF delivery power, (c) temperature. Hit the ESC key to return to the measurements screen menu, or return to the main menu screen and select measurements.

Measurements :	[2000]
Power	
Transport Stream	
-> Drawers	↓

Exciter Power Supply	
Communication Status	
Power Supply	↑

Select **Drawers** and presses ENTER.

Drawer Measurements :	[2300]
-> Power	
Current	
Temperature	

Select **Power** and presses ENTER

Drawer Power Measurements :	[2310]
Drawer : <_/_>	
32V Power Supply: ___.[V]	
Forward Power: ___.[W]	

To select a specific drawer, press the keys “2” or “4”.

Drawer Measurements :	[2300]
Power	
-> Current	
Temperature	

Select **Current** and press ENTER.

Drawer Current Measurements :	[2320]
Drawer : <_/_>	^More Modules^
-> Mod. 1 I1: ___ A	Mod. 1 I2: ___ A
Mod. 2 I1: ___ A	Mod. 2 I2: ___ A

Mod. 3 I1: ___ A	Mod. 3 I2: ___ A
Mod. 4 I1: ___ A	Mod. 4 I2: ___ A
Excit. I1: ___ A	Excit. I2: ___ A

Press ESC to return to the **Drawers Measurements** screen.

```

Drawer Measurements :                [2300]
  Power
  Current
  -> Temperature
    
```

Select **Temperature** and press ENTER

```

Drawer Temperature Measurements :    [2330]
Drawer : <_/_>   Exciter: 0.0 °C    ^°F^
  Mod.1: 0.0 °C      Mod.3: 0.0 °C
  Mod.2: 0.0 °C      Mod.4: 0.0 °C
    
```

Press ESC to return to the **Measurements** screen.

```

Measurements :                       [2000]
  Power
  Transport Stream
  Drawers
    
```

```

-> Exciter Power Supply
  Communication Status
  Power Supply
    
```

Select **Exciter Power Supply** and press ENTER

```

Exciter Power Supply :                [2400]
-> +15V : OK
  +8V  : Fail
  +3V  : OK
    
```

```

+27V : Fail
    
```

- Use the Up and Down keys, 1 and 3, to check the voltage status on the DTV exciter.
- To return to the Main Menu press ESC key.

#### 4.4 Communication among RF drawers

From the LCD screen it is possible to conduct and view a diagnostic check of the communication link between the master control unit and each one of the RF power amplifier drawers.

Press ESC, to the Main Menu screen, and then to the screen [2000] is reached, as below:

Measurements :	[2000]
Power	
Transport Stream	↓
Drawers	

Exciter Power Supply	↑
-> Communication Status	
Power Supply	

Select **Communication Status** and press ENTER.

Communication Status :	[2500]
P01: OK P02: OK P03 OK P04: OK	

Press the ESC key to return to the Main Menu.

#### 4.5 Voltages from the Power Supplies

To check the status of the value and presence of the power supplies, start from the Main Menu and select the Measurement [2000] screen.

Measurements :	[2000]
Power	
Transport Stream	↓
Drawers	

Exciter Power Supply	↑
Communication Status	
-> Power Supply	

Select **Power Supply** and press ENTER

Power Supply Measurements :
15V : OK
8V : OK
Battery: 12.5 [V]

Press the ESC key as many times as necessary to return to the main menu.

## 5. The alarm system

An alarm is indicated by one of the 3 red LEDs located on the front panel of the digital exciter. The first LED alarm is for transport stream (TS) absence (SYNC. LOSS). The next LED alarm is for a current malfunction present on the equipment, and requires investigation, (see CURRENT ALARM). The third LED indicates a past alarm (see PAST ALARM). This situation that past alarm, is no longer present. On normal operation, just a green LED is ON, which confirms that the AC input power is present. Once a CURRENT ALARM LED is ON, the origin of the alarm should be investigated.

From the Main Menu screen, access the System Alarm/Log.

```
Main Menu : [0000]
  Setup Menu
  Measurements
  -> System Alarms/Log ↓
```

```
Remote Access ↑
```

### Access System Alarms/Log

```
System Alarm/Log [3000]
  -> Current Alarms
  Alarm Log
  Drawers Alarms ↓
```

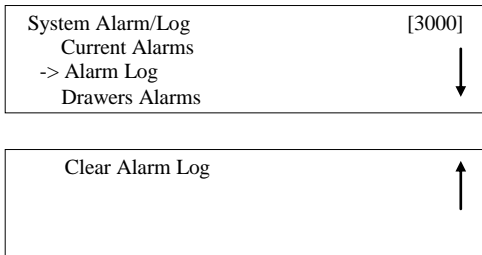
```
Clear Alarm Log ↑
```

Select **Current Alarms** and press ENTER

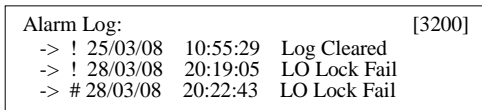
```
Current Alarms: [3100]
  Alarm List Empty!
```

- The “Alarm List Empty!” means the alarm is no longer present.

Press ESC to return to the System Alarms/ Log menu



Access the Alarm Log and press ENTER to view all alarms, current and past alarms.



The symbol '!' is an indication that the alarm is current, (LED ON for alarms) with date and time of its occurrence. The symbol '#' is an indication that any alarms are no longer present, (LED ON for past alarm, LED OFF for current alarms), and the date and time mark when it ceased to occur. The alarm log keeps up to 100 registers.

The **Clear Alarm Log**, if selected, erases the alarm log registers and then registers the date and time when the alarms were erased.

The table below shows all possible alarms generated on the Digital Exciter and the associated suggested action to cease its occurrence.

Alarm Message	Alarm Description	Action Required	After Alarm Ceases
Sync Loss!	Sync loss on the transport stream	Alarm LED ON	Alarm LED OFF Past alarm LED ON
LO Lock Fail!	Up-Converter LO PLL unlocked	Shut down RF Re-program the PLL	Returns to the last RF level
Clock Lock Fail!	Clock at Modulator unlocked	Alarm LED ON	-----
Fifo Overflow!	Overflow on FIFO at the modulator	Alarm LED ON	-----
+15V Fail!	Lack of +15V.	Alarm LED ON	-----
+8V Fail!	Lack of +8V.	Alarm LED ON	-----
+3V Fail!	Lack of +3V.	Alarm LED ON	-----
+27V Fail!	Lack of +27V.	Alarm LED ON	-----

## 5.1 Drawer Alarms

While in the **System Alarm/Log** screen it is possible to check and review all alarms, current and past, on each one of RF power drawers. From the Main Menu screen select system alarm/log, screen [3000].

```
Main Menu : [0000]
  Setup Menu
  Measurements
  -> System Alarms/Log
```

```
Remote Access
```

Select **System Alarms/Log** and ENTER

```
System Alarm/Log [3000]
  Current Alarms
  Alarm Log
  -> Drawers Alarms
```

```
Clear Alarm Log
```

Select **Drawer Alarms** and press ENTER.

```
Drawer Alarms: [3300]
  -> Current Alarms
  Past Alarms
```

Select **Current Alarms** and press ENTER to check current alarms

```
Drawer : <_/_> Current Alarms: [3310]
Alarm List Empty!
```

Use the keys (4) ◀ or (2) ▶ to select one among many RF power drawers.

Press key ESC to return to the previous screen, **Drawer Alarms**. On the screen [3320], press the keys (4) ◀ or (2) ▶ to select the drawer.

```
Drawer : <_/_> Past Alarms: [3320]
Alarm List Empty!
```



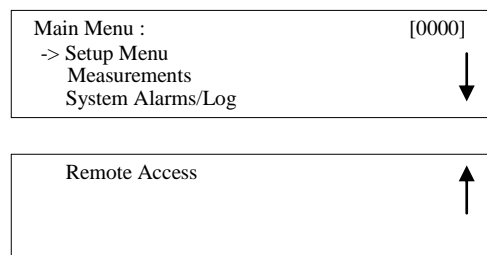
## 6. Setup

The SETUP screens permits for selection and changes on the configuration and operational parameters. The menu below profiles the possible operations under SETUP.

Items on the SETUP menu	Description
Power Setup	Program the RF output power level
Frequency Setup	Program the RF UHF Channel of the transmitter
Image Frequency Suppression	TX Balance, eliminated the image frequencies band
LO Leakage Suppression	Reduces the LO undesirable spurious
Pre-Correction	Enable and Disable the pre-correction circuitry
Pilot Level	Adjust the pilot level [ -2.048 ~ +511]
Time and Date Setup	Set time and date
Password Setup	Password configuration

### 6.1 Output Power Setup

Starting from the Main Menu



Select **Setup Menu** and press ENTER

Setup Menu :	[1000]
-> Power Setup	
Frequency Setup	↓
Image Frequency Suppression	

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	↓
Time and Date Setup	

Password Setup	
Transmitter Setup	↑

Select **Power Setup** and press ENTER

Power Setup :
Output: 1300 [W]
Program: 1300 [W]

To reach the desirable output power level, press the key (2)▶, to increase the power or (4)◀ to decrease the power. Once the desirable power level is adjusted, press ENTER for software acknowledgement, otherwise the change will not become effective.

## 6.2 Channel Frequency Setup

The channel frequency change is illustrated here, but it is a parameter that cannot be changed by the operator in the field. It is factory adjusted only. Starting at the setup menu screen [1000]:

Setup Menu :	[1000]
Power Setup	
-> Frequency Setup	↓
Image Frequency Suppression	

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	↓
Time and Date Setup	

Password Setup	
Transmitter Setup	↑

Select **Frequency Setup** and press ENTER

```
Frequency Setup : [1200]
-> Channel :
Offset
Model
```

Select **Channel** and press ENTER

```
Channel Setup : [1210]
Channel : ____ Offset: + __.____ kHz
Center Frequency: ____ . ____ MHz
Pilot Frequency : ____ . ____ MHz
```

Press ESC to return to **Frequency Setup**.

```
Frequency Setup : [1200]
Channel :
-> Offset
Model
```

Select **Offset** and press ENTER

```
Frequency Offset Adjustment: [1220]
Frequency Offset: + __.____ kHz
```

- The offset can be configured within 1Hz steps, in a  $\pm 65536$  Hz scale.

Press ESC to return to the **Frequency Setup** screen.

```
Frequency Setup : [1200]
Channel :
Offset
-> Model
```

Select **Model** and press ENTER

```
Transmitter Model Selection: [1230]
Transmitter Model: AT7xxx
```

Press ESC to return to the **Setup Menu**

```

Setup Menu : [1000]
  Power Setup
  Frequency Setup
  -> Image Frequency Suppression
  
```

```

LO Leakage Suppression
Pre-Correction
Modulation Settings
Time and Date Setup
  
```

```

Password Setup
Transmitter Setup
  
```

Select **Image Frequency Suppression** and press ENTER.

### 6.3 Image Frequency Suppression

This software feature adjusts numerical values related with the amplitude and phase optimized for maximum image frequency suppression on the superior side band spectrum region. An RF sample for monitoring purposes must be taken before the output mask filter.

The amplitude values are shown in dB, and the phase related values are shown in degrees.

```

Image Frequency Suppression: [1300]
-> I Amplitude : [dB]
   Q Amplitude: [dB]
   I Phase   : °
  
```

```

Q Phase   : °
  
```

Press ESC to return to the **Setup Menu**.

```

Setup Menu : [1000]
  Power Setup
  Frequency Setup
  Image Frequency Suppression
  
```

```

-> LO Leakage Suppression
Pre-Correction
Modulation Settings
Time and Date Setup
  
```

```

Password Setup
Transmitter Setup
  
```

Select **LO Leakage Suppression** and press ENTER.

### 7.4 LO Leakage Suppression

An RF sample for monitoring purposes must be taken before the output mask filter. An ideal voltage in the range of -60 [mV] and +60 [mV] should be sought, and will cancel the LO leakage for the main RF amplifiers

LO Leakage Suppression:	[1400]
-> I Offset :	[mV]
Q Offset:	[mV]

Using the keys, it's possible to activate or deactivate the linear and non-linear pre-correction.

ON: Activate Pre-correction

OFF: Deactivate Pre-correction

### 7.5 Pre-correction adjustment

Press ESC to return to the **Setup Menu**.

Setup Menu :	[1000]
Power Setup	↓
Channel Setup	
Image Frequency Suppression	

LO Leakage Suppression	↑
-> Pre-Correction	
Pilot Level	
Time and Date Setup	

Select **Pre-Correction** and press ENTER

Pre-Correction Setup:	[1500]
-> Linear	
Non-Linear	

Select **Linear** and press ENTER

Linear Pre-Correction:	[1510]
Linear Pre-correction: on/off	

Press ESC to return to **Pre-correction Setup**.

```
Pre-Correction Setup:          [1500]
  Linear
  -> Non-Linear
```

Select **Non-Linear** and press ENTER

```
Non-Linear Pre-Correction:    [1520]
  -> Non-Linear Pre-correction: on/off
  Scale: -300 ~ +300
```

The scale listed on the screen above, is related with how intense the pre-correction will act over the ATSC signal on the modulator.

## 7.6 Modulation Settings

On this screen option it's possible to turn the modulation process on and off. It is also possible to adjust the pilot level rating from -2048 to +511. Press ESC up to the **SETUP MENU** screen.

```
Setup Menu :                  [1000]
  Power Setup
  Frequency Setup
  Image Frequency Suppression ↓
```

```
LO Leakage Suppression
Pre-Correction
-> Modulation Settings ↓
Time and Date Setup
```

```
Password Setup
Transmitter Setup ↑
```

Select **Modulation Settings** and press ENTER.

```
Modulation Settings :        [1600]
  Modulation : on/off
  Pilot Level offset : +0000
                        (-2.048 to 511)
```

## 7.7 Time and date configuration

Press ESC up to Setup Menu screen.

Setup Menu :	[1000]
Power Setup	↓
Frequency Setup	
Image Frequency Suppression	
LO Leakage Suppression	↓
Pre-Correction	
Modulation Settings	
-> Time and Date Setup	
Password Setup	↑
Transmitter Setup	

Select **Time and Date Setup** and press ENTER

Time and Date Setup:	[1700]	
Time: HH:MM	Date: 25/02/11	DD/MM/YY

To program the date and time, use keys 2 and 4. To change between the parameters, use keys 1 and 3.

## 7.8 Password Setup

Once a password is composed (by four numbers) it will become the set password for the equipment. Please be certain to capture and store your password in a safe place.

To set the password, use the keys 2 and 4 to move the arrow head under each one of the 4 password positions. The 1 and 3 keys increase or decrease the numerical value of the each position. Once a password is selected the screen will return to the main menu screen. Please follow the sequence below for a complete understanding of the password setup process.

Press ESC key up to activate the **SETUP MENU** screen:

Setup Menu :	[1000]
Power Setup	
Frequency Setup	
Image Frequency Suppression	↓

LO Leakage Suppression	
Pre-Correction	
Modulation Settings	
Time and Date Setup	↓

-> Password Setup	
Transmitter Setup	↑

### Access to the **Password Setup**

Password Setup:	[1800]
-> Enable / choose new password	
Disable password	

To enable the password or set a new one, select Enable / **choose new password**.

New Password:	[1810]
0 0 0 0	
Write new password	

## 8. Remote system supervision (Tele-supervision)

Each parameter associated with the transmitter such us:

- RF Power Level
- Power Supply voltage readings
- Alarms, and
- Other functional parameters

...can be monitored in two possible ways:

- Via Front Panel – Local access via LCD screen and keypad (as profiled in this section).
- Using a PC local or remote access via Ethernet.

It is possible to configure, alter and change functions and monitor each of their performances.



## 8.1 IP Configuration

Start from the Main Menu

Main Menu:	[0000]
Setup Menu	
Measurements	
System Alarms/Log	↓

-> Remote Access	↑
------------------	---

Select **Remote Access** and press ENTER

Remote Access:	[4000]
-> IP Address	
Subnetwork Mask	
Gateway	

Select **IP Address** and press ENTER.

IP Address:	[4100]
192.168.100.018	

- Navigate and configure the IP by using the keys 1 or 3 and 2 or 4.

## 8.2 Mask Configuration

Press ESC up to the **Remote Access** screen

Remote Access:	[4000]
IP Address	
-> Subnetwork Mask	
Gateway	

Select **Subnetwork Mask** and press ENTER

Subnetwork Mask:	[4200]
192.168.100.018	

Configure the Mask using the keys 1 or 3 and 2 or 4.

### 8.3 Gateway Configuration

Press ESC up to the **Remote Access** screen

Remote Access:	[4000]
IP Address	
Subnetwork Mask	
-> Gateway	

Access the **Gateway** and press ENTER

Gateway:	[4300]
192.168.100.018	

Configure the gateway address using 1 or 3 and 2 or 4.